Rationality in Financial Markets: Evidence From Bank Loan Financing Arrangements and Security Analysts' Earnings Forecasts

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Question

Do banks rationally use analysts' earnings forecasts to determine loan interest rates?

Simple Example

The Scenario

- Assume General Motors (GM) applies for a line of credit from Bank of America
- **Problem**: Bank may want information regarding GM's future earnings potential or earnings risk
- **Solution**: Bank may gather security analysts' earnings forecasts for GM

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Simple Example Cont...

However, analysts' earnings forecasts are:

- Not perfect
- Possibly exaggerated

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Rephrase the Question

Do banks make systematic mistakes accounting for both the exaggerations and the lack of precision in analysts' earnings forecasts?

Contribution

Three Contributions

- Examination as to whether banks rationally use analysts' forecasts to determine loan interest rates
- Examine analysts impact on ex-ante cost of capital. Previous Literature uses ex-post equity returns.(Rajan and Savares (1997),Dechow, Hutton, and Sloan (1999), Bradshaw, Skinner, and Sloan (2006), Michaely and Womack (1999))
- Use System GMM estimator to estimate exogenous influence of analysts' forecasts for bank loan interest rate determination

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Simple Model

The Agents

- Bank
- **Large** publicly traded firm
- Security Analysts

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Simple Model Cont...

Analysts' Consensus Earnings Forecasts-A Noisy Signal

- $S^a = \theta + \eta$
- $\theta \sim N\left(\mu_\theta, \sigma_\theta^2\right)$
- $\eta \sim N\left(\mu_\eta, \sigma_\eta^2\right)$

Simple Model Cont...

Conditional Mean and Variance: Return Per Dollar of Assets

- $\hat{\theta} = \mu_\theta + \frac{\sigma_\theta^2}{\sigma_\theta^2 + \phi\sigma_\eta^2}\left(S^a - \mu_\theta - \kappa\mu_\eta\right)$ where $\kappa < 1, \phi < 1$
- $\hat{\sigma}_\theta^2 = \frac{\phi\sigma_\theta^2\sigma_\eta^2}{\sigma_\theta^2 + \phi\sigma_\eta^2}$

Simple Model Cont...

Banks Problem: Maximize Profits

$$R^* \in \arg\max_R \pi = BR + E\left[I\theta - BR | S^a, \theta < \frac{BR}{I}\right] - (1+\rho)B$$

Simple Model Cont...

Solution to Banks Problem

- $\frac{\partial \pi}{\partial R} = 1 - \Pr\left[\theta < \frac{BR}{I}\right]$
- $\pi = BR + E\left[I\theta - BR | S^a, \theta < \frac{BR}{I}\right] - (1+\rho) B = 0$

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Simple Model Cont...

Correctly Accounting For The Forecast Bias

- $\frac{\partial R^*}{\partial S^a} = -\frac{\sigma_\theta^2}{\sigma_\theta^2+\phi\sigma_\eta^2} \frac{E\left[(I\theta - BR^*)\frac{(\theta-\hat{\theta})}{\hat{\sigma}_\theta^2}|S^a, \theta < \frac{BR^*}{I}\right]}{\frac{\partial \pi}{\partial R^*}} < 0$
- $\frac{\partial R^*}{\partial \mu_\eta} = \frac{\kappa\sigma_\theta^2}{\sigma_\theta^2+\phi\sigma_\eta^2} \frac{E\left[(I\theta - BR^*)\frac{(\theta-\hat{\theta})}{\hat{\sigma}_\theta^2}|S^a, \theta < \frac{BR^*}{I}\right]}{\frac{\partial \pi}{\partial R^*}} > 0$
- $\frac{\partial R^*}{\partial S^a} + \frac{\partial R^*}{\partial \mu_\eta} = 0$ for $\kappa = 1$

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- $\frac{\partial R^*}{\partial S^a} + \frac{\partial R^*}{\partial \mu_\eta} = 0$ for $\kappa = 1$

Simple Model Cont...

Correctly Accounting For The Lack of Precision

$$\phi = \frac{\sigma_\theta^2 \frac{\partial R^*}{\partial \mu_\theta}}{\sigma_\eta^2 \frac{\partial R^*}{\partial S^a}} = 1$$

Empirical Estimation

Data

- DEALSCAN
- I/B/E/S
- COMPUSTAT

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Empirical Estimation Cont...

Econometric Model

$$INTR_{i,t} =$$
$$\alpha_0 + \beta_1 RQ_{i,t} + \beta_2 MFE_{i,t-1} + \beta_3 MPE_{i,t-1} + \gamma Z + \omega_i + \tau_t + \varepsilon_{i,t}$$

Comparative Static Estimates

- $\frac{\partial R^*}{\partial S^a} \Rightarrow \beta_1$
- $\frac{\partial R^*}{\partial \mu_\eta} \Rightarrow \beta_2$
- $\frac{\partial R^*}{\partial \mu_\theta} \Rightarrow \beta_3$

Empirical Estimation Cont...

Estimation Methodology

- GMM System Estimator
- Arellano and Bover (1995), Blundell and Bond (1998)

Results

Long Term Earnings Forecast	-0.0895***
	(0.0371)
Mean of Past Forecast Errors	2.4477***
	(1.0637)
Stdev of Past Forecast Errors	0.0086
	(1.1722)
Mean of Past Earnings	-1.8310***
	(0.4975)
Number of Firms	1890
Number of Observations	5777
P-Value Hansen Test of Overidentifying Restrictions	0.259
Test of Second Order Serial Correlation P-Value	0.271

Results

Current Fiscal Year Earnings Forecast	-1.5724***
	(0.6718)
Mean of Past Forecast Errors	2.0572***
	(1.0700)
Stdev of Past Forecast Errors	3.1131***
	(1.3111)
Mean of Past Earnings	-0.9170***
	(0.4544)
Number of Firms	2233
Number of Observations	6826
P-Value Hansen Test of Overidentifying Restrictions	0.262
Test of Second Order Serial Correlation P-Value	0.404

Empirical Estimation Cont...

Econometric Model

$$INTR_{i,t} = \alpha_0 + \beta_1 RQ_{i,t} + \beta_2 MFE_{i,t-1} + \beta_3 MPE_{i,t-1} + \gamma Z + \omega_i + \tau_t + \varepsilon_{i,t}$$

Econometric Tests

- $\frac{\partial R^*}{\partial S^a} + \frac{\partial R^*}{\partial \mu_\eta} \Rightarrow \beta_1 + \beta_2 = 0.48 \Rightarrow \kappa \Rightarrow 1.30$
- $\phi = \frac{\sigma_\theta^2 \frac{\partial R^*}{\partial \mu_\theta}}{\sigma_\eta^2 \frac{\partial R^*}{\partial S^a}} \Rightarrow \hat{\phi} = \frac{\sigma_\theta^2 \beta_3}{\sigma_\eta^2 \beta_1} = .927$

Empirical Estimation Cont...

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Does Earnings Forecast Proxy for the Banks Private Information

- $RQ_{i,t} = RQ^b_{i,t} + \upsilon_{i,t}$
- $COV\left[\omega_i + \varepsilon_{i,t} + \beta_1 \upsilon_{i,t}, \Delta RQ^b_{i,t-s} + \Delta \upsilon_{i,t-s}\right] \neq 0$
- $COV\left[\Delta \varepsilon_{i,t} + \beta_1 \Delta \upsilon_{i,t}, RQ^b_{i,t-z} + \upsilon_{i,t-z}\right] \neq 0$

Empirical Estimation Cont...

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Conclusions

- Banks account for forecast bias and precision
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